9.2 General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2003. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

9.3 WCDMA Measurement Procedures for SAR

The following procedures are applicable to WCDMA handsets operating under 3GPP Release99, Release 5 and Release 6. The default test configuration is to measure SAR with an established radio link between the DUT and a communication test set using a 12.2kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations (DPCCH & $DPDCH_n$), HSDPA and HSPA (HSUPA/HSDPA) modes according to output power, exposure conditions and device operating capabilities. Both uplink and downlink should be configured with the same RMC or AMR, when required. SAR for Release 5 HSDPA and Release 6 HSPA are measured using the applicable FRC (fixed reference channel) and E-DCH reference channel configurations. Maximum output power is verified according to applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. When Maximum Power Reduction (MPR) is not implemented according to Cubic Metric (CM) requirements for Release 6 HSPA, the following procedures do not apply.

For Release 5 HSDPA Data Devices:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	CM/dB
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15	15/15	64	12/15	24/25	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

For Release 6 HSPA Data Devices

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	3.0	2.0	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	1.0	0.0	21	81

For Release 8

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel. 5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.

9.4 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

9.5 Power Drift

To control the output power stability during the SAR test, DASY4 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in section 14 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

10 Area Scan Based 1-g SAR

10.1 Requirement of KDB

According to the KDB447498 D01 v05, when the implementation is based the specific polynomial fit algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007) and the estimated 1-g SAR is ≤ 1.2 W/kg, a zoom scan measurement is not required provided it is also not needed for any other purpose; for example, if the peak SAR location required for simultaneous transmission SAR test exclusion can be determined accurately by the SAR system or manually to discriminate between distinctive peaks and scattered noisy SAR distributions from area scans.

There must not be any warning or alert messages due to various measurement concerns identified by the SAR system; for example, noise in measurements, peaks too close to scan boundary, peaks are too sharp, spatial resolution and uncertainty issues etc. The SAR system verification must also demonstrate that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR (See Annex B). When all the SAR results for each exposure condition in a frequency band and wireless mode are based on estimated 1-g SAR, the 1-g SAR for the highest SAR configuration must be determined by a zoom scan.

10.2 Fast SAR Algorithms

The approach is based on the area scan measurement applying a frequency dependent attenuation parameter. This attenuation parameter was empirically determined by analyzing a large number of phones. The MOTOROLA FAST SAR was developed and validated by the MOTOROLA Research Group in Ft. Lauderdale.

In the initial study, an approximation algorithm based on Linear fit was developed. The accuracy of the algorithm has been demonstrated across a broad frequency range (136-2450 MHz) and for both 1- and 10-g averaged SAR using a sample of 264 SAR measurements from 55 wireless handsets. For the sample size studied, the root-mean-squared errors of the algorithm are 1.2% and 5.8% for 1- and 10-g averaged SAR, respectively. The paper describing the algorithm in detail is expected to be published in August 2004 within the Special Issue of Transactions on MTT.

In the second step, the same research group optimized the fitting algorithm to an Polynomial fit whereby the frequency validity was extended to cover the range 30-6000MHz. Details of this study can be found in the BEMS 2007 Proceedings.

Both algorithms are implemented in DASY software.

11 Conducted Output Power

When WLAN Hotspot mode is activated (AP ON), the conducted output power will be reduced for WCDMA1900. When WLAN Hotspot mode is deactivated (AP OFF), the RF output power level return to their normal RF power level.

11.1 Manufacturing tolerance

When the hotspot mode is ON:

Table 11.1: WCDMA

WCDMA 1900 CS			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	21.5	21.5	21.5
Tune-up(dBm)	22.5	22.5	22.5
HSUPA (sub-test 1/5)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	21	21	21
Tune-up(dBm)	22	22	22
HSUPA (sub-test 2/3)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	20	20	20
Tune-up(dBm)	21	21	21
HSUPA (sub-test 4)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	20.5	20.5	20.5
Tune-up(dBm)	21.5	21.5	21.5
DC-HSDPA (sub-test 1-4)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	21	21	21
Tune-up(dBm)	22	22	22

When the hotspot mode is OFF:

Table 11.2: GSM Speech

GSM 850			
Channel	Channel 251	Channel 190	Channel 128
Target (dBm)	32.5	32.5	32.5
Tune-up (dBm)	33.5	33.5	33.5
GSM 1900			
Channel	Channel 810	Channel 661	Channel 512
Target (dBm)	29.5	29.5	29.5
Tune-up (dBm)	30.5	30.5	30.5

Table 11.3: GPRS and EGPRS

GSM 850 GPRS/EGPRS (GMSK)				
Channel		**251**	**190**	**128**
1 Txslot	Target (dBm)	32.5	32.5	32.5
	Tune-up (dBm)	33.5	33.5	33.5
2 Txslots	Target (dBm)	30.5	30.5	30.5
	Tune-up (dBm)	31.5	31.5	31.5
3 Txslots	Target (dBm)	28.5	28.5	28.5
	Tune-up (dBm)	29.5	29.5	29.5
4 Txslots	Target (dBm)	27.5	27.5	27.5
	Tune-up (dBm)	28.5	28.5	28.5
GSM 850 EGPRS (8PSK)				
Channel		**251**	**190**	**128**
1 Txslot	Target (dBm)	27	27	27
	Tune-up (dBm)	28	28	28
2 Txslots	Target (dBm)	25.5	25.5	25.5
	Tune-up (dBm)	26.5	26.5	26.5
3 Txslots	Target (dBm)	24	24	24
	Tune-up (dBm)	25	25	25
4 Txslots	Target (dBm)	22.5	22.5	22.5
	Tune-up (dBm)	23.5	23.5	23.5
GSM 1900 GPRS/EGPRS (GMSK)				
Channel		**810**	**661**	**512**
1 Txslot	Target (dBm)	29.5	29.5	29.5
	Tune-up (dBm)	30.5	30.5	30.5
2 Txslots	Target (dBm)	27.5	27.5	27.5
	Tune-up (dBm)	28.5	28.5	28.5
3 Txslots	Target (dBm)	26	26	26
	Tune-up (dBm)	27	27	27
4 Txslots	Target (dBm)	25	25	25
	Tune-up (dBm)	26	26	26
GSM 1900 EGPRS (8PSK)				
Channel		**810**	**661**	**512**
1 Txslot	Target (dBm)	26	26	26
	Tune-up (dBm)	27	27	27
2 Txslots	Target (dBm)	24.5	24.5	24.5
	Tune-up (dBm)	25.5	25.5	25.5
3 Txslots	Target (dBm)	23	23	23
	Tune-up (dBm)	24	24	24
4 Txslots	Target (dBm)	21.5	21.5	21.5
	Tune-up (dBm)	22.5	22.5	22.5

Table 11.4: WCDMA

WCDMA 850 CS			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	23	23	23
Tune-up (dBm)	24	24	24
HSUPA (sub-test 1/4/5)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	22	22	22
Tune-up (dBm)	23	23	23
HSUPA (sub-test 2)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21.5	21.5	21.5
Tune-up (dBm)	22.5	22.5	22.5
HSUPA (sub-test 3)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21	21	21
Tune-up (dBm)	22	22	22
DC-HSDPA (sub-test 1~4)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	22	22	22
Tune-up (dBm)	23	23	23
WCDMA 1700 CS			
Channel	Channel 1513	Channel 1412	Channel 1312
Target (dBm)	23	23	23
Tune-up (dBm)	24	24	24
HSUPA (sub-test 1/4/5)			
Channel	Channel 1513	Channel 1412	Channel 1312
Target (dBm)	22	22	22
Tune-up (dBm)	23	23	23
HSUPA (sub-test 2/3)			
Channel	Channel 1513	Channel 1412	Channel 1312
Target (dBm)	21.5	21.5	21.5
Tune-up (dBm)	22.5	22.5	22.5
DC-HSDPA (sub-test 1~4)			
Channel	Channel 1513	Channel 1412	Channel 1312
Target (dBm)	22	22	22
Tune-up (dBm)	23	23	23
WCDMA 1900 CS			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	23	23	23
Tune-up (dBm)	24	24	24
HSUPA (sub-test 1/4)			
Channel	Channel 9538	Channel 9400	Channel 9262

Target (dBm)	22	22	22
Tune-up (dBm)	23	23	23
HSUPA (sub-test 2)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	21.5	21.5	21.5
Tune-up (dBm)	22.5	22.5	22.5
HSUPA (sub-test 3)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	21	21	21
Tune-up (dBm)	22	22	22
HSUPA (sub-test 5)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	23	23	23
Tune-up (dBm)	24	24	24
DC-HSDPA (sub-test 1~4)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	22	22	22
Tune-up (dBm)	23	23	23

Table 11.5: Bluetooth

GFSK			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	5	5	5
Tune-up (dBm)	6	6	6

Table 11.6: WiFi

Mode	Target (dBm)	Tune-up (dBm)
802.11b	17	18
802.11g 6Mbps~24Mbps	15	16
802.11g 36Mbps~54Mbps	14	15
802.11n-HT20 MCS0~ MCS3	13	14
802.11n-HT20 MCS4~ MCS7	12	13

11.2 Hotspot

The conducted power is normal for all bands except WCDMA1900. There is power reduction enabled for WCDMA1900. The power reduction is enabled when the user enables hotspot mode via the manufacturer software. The tables below show the measured powers with hotspot.

Table 11.7: The conducted Power for WCDMA

Item	band	FDDII result		
	ARFCN	9538(1907.6MHz)	9400(1880MHz)	9262(1852.4MHz)
WCDMA	\	22.47	22.49	22.50
HSUPA	1	20.72	20.77	20.72
	2	20.10	20.29	20.10
	3	19.73	19.85	19.73
	4	20.66	20.88	20.66
	5	21.06	21.25	21.06
DC-HSDPA	1	20.96	21.06	21.03
	2	20.92	21.02	21.01
	3	20.93	21.01	21.02
	4	20.93	21.03	21.03

11.3 GSM Measurement result

During the process of testing, the EUT was controlled via Agilent Digital Radio Communication tester (E5515C) to ensure the maximum power transmission and proper modulation. This result contains conducted output power for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

Table 11.8: The conducted power measurement results for GSM850/1900 for head

GSM 850MHz	Conducted Power (dBm)		
	Channel 251(848.8MHz)	Channel 190(836.6MHz)	Channel 128(824.2MHz)
	32.56	32.50	32.66
GSM 1900MHz	Conducted Power (dBm)		
	Channel 810(1909.8MHz)	Channel 661(1880MHz)	Channel 512(1850.2MHz)
	29.64	29.50	29.35

Table 11.9: The conducted power measurement results for GPRS and EGPRS for body

GSM 850 GPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	251	**190**	**128**		**251**	**190**	**128**
1 Txslot	32.23	32.56	32.45	-9.03	23.20	23.53	23.42
2 Txslots	**30.34**	**30.37**	**30.47**	**-6.02**	**24.32**	**24.35**	**24.45**
3Txslots	28.57	28.53	28.77	-4.26	24.31	24.27	24.51
4 Txslots	27.21	27.27	27.51	-3.01	24.20	24.26	24.50
GSM 850 EGPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	251	**190**	**128**		**251**	**190**	**128**
1 Txslot	32.24	32.56	32.45	-9.03	23.21	23.53	23.42
2 Txslots	**30.35**	**30.38**	**30.67**	**-6.02**	**24.33**	**24.36**	**24.65**
3Txslots	28.57	28.52	28.77	-4.26	24.31	24.26	24.51
4 Txslots	27.21	27.22	27.52	-3.01	24.20	24.21	24.51

GSM 850 EGPRS (8PSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	251	**190**	**128**		**251**	**190**	**128**
1 Txslot	26.01	26.09	26.19	-9.03	16.98	17.06	17.16
2 Txslots	24.79	24.95	25.01	-6.02	18.77	18.93	18.99
3Txslots	23.14	23.25	23.37	-4.26	18.88	18.99	19.11
4 Txslots	21.50	21.55	21.61	-3.01	18.49	18.54	18.60
PCS1900 GPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	**661**	**512**		**810**	**661**	**512**
1 Txslot	29.60	29.50	29.45	-9.03	20.57	20.47	20.42
2 Txslots	27.54	27.54	27.62	-6.02	21.52	21.52	21.60
3Txslots	**26.00**	**25.94**	**25.95**	**-4.26**	**21.74**	**21.68**	**21.69**
4 Txslots	24.69	24.64	24.68	-3.01	21.68	21.63	21.67
PCS1900 EGPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	**661**	**512**		**810**	**661**	**512**
1 Txslot	29.60	29.50	29.45	-9.03	20.57	20.47	20.42
2 Txslots	27.53	27.54	27.62	-6.02	21.51	21.52	21.60
3Txslots	**25.98**	**25.93**	**25.91**	**-4.26**	**21.72**	**21.67**	**21.65**
4 Txslots	24.68	24.61	24.65	-3.01	21.67	21.60	21.64
PCS1900 EGPRS (8PSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	**661**	**512**		**810**	**661**	**512**
1 Txslot	25.36	25.36	25.41	-9.03	16.33	16.33	16.38
2 Txslots	24.21	24.20	24.25	-6.02	18.19	18.18	18.23
3Txslots	22.56	22.52	22.60	-4.26	18.30	18.26	18.34
4 Txslots	20.94	20.87	20.93	-3.01	17.93	17.86	17.92

NOTES:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

According to the conducted power as above, the body measurements are performed with 2Txslots for GSM850 and 3Txslots for PCS1900.

11.4 WCDMA Measurement result

Table 11.10: The conducted Power for WCDMA for head

Item	band	FDDV result		
	ARFCN	4233 (846.6MHz)	4182 (836.4MHz)	4132 (826.4MHz)
WCDMA	\	23.45	23.28	23.27
HSUPA	1	21.58	21.53	21.30
	2	20.89	20.92	20.65
	3	20.46	20.52	20.84
	4	21.41	21.41	21.43
	5	21.94	21.88	21.88
DC-HSDPA	1	21.91	21.99	21.83
	2	21.89	21.82	21.82
	3	21.87	21.85	21.82
	4	21.92	21.83	21.79
Item	band	FDDIV result		
	ARFCN	1513 (1752.6MHz)	1412 (1732.4MHz)	1312 (1712.4MHz)
WCDMA	\	23.57	23.60	23.55
HSUPA	1	21.84	21.84	21.44
	2	20.62	21.14	21.01
	3	21.02	20.77	20.59
	4	21.72	21.71	21.48
	5	22.12	22.16	21.93
DC-HSDPA	1	22.15	22.09	22.21
	2	22.12	22.08	22.18
	3	22.09	22.05	22.15
	4	22.11	22.05	22.17
Item	band	FDDII result		
	ARFCN	9538 (1907.6MHz)	9400 (1880MHz)	9262 (1852.4MHz)
WCDMA	\	23.83	23.78	23.68
HSUPA	1	21.88	21.76	21.33
	2	21.15	21.10	20.71
	3	20.81	20.77	20.38
	4	21.68	21.70	21.62
	5	22.2	22.12	22.10
DC-HSDPA	1	22.38	22.22	22.32
	2	22.35	22.19	22.23
	3	22.32	22.25	22.25
	4	22.37	22.17	22.28

Table 11.11: The conducted Power for WCDMA for body

Item	band	FDDV result		
	ARFCN	4233 (846.6MHz)	4182 (836.4MHz)	4132 (826.4MHz)
WCDMA	\	23.37	23.38	23.28
HSUPA	1	21.81	21.81	21.62
	2	21.11	21.10	21.16
	3	20.71	20.78	20.80
	4	21.69	21.70	21.65
	5	22.18	22.15	22.22
DC-HSDPA	1	21.85	21.85	21.67
	2	21.81	21.87	21.65
	3	21.78	21.82	21.66
	4	21.83	21.84	21.63
Item	band	FDDIV result		
	ARFCN	1513 (1752.6MHz)	1412 (1732.4MHz)	1312 (1712.4MHz)
WCDMA	\	23.45	23.45	23.39
HSUPA	1	22.21	22.27	22.57
	2	21.52	21.69	21.30
	3	21.15	21.28	21.52
	4	22.01	22.07	22.08
	5	22.58	22.54	22.55
DC-HSDPA	1	22.12	22.19	22.13
	2	22.07	22.17	22.08
	3	22.11	22.17	22.06
	4	22.12	22.15	22.11
Item	band	FDDII result		
	ARFCN	9538 (1907.6MHz)	9400 (1880MHz)	9262 (1852.4MHz)
WCDMA	\	23.39	23.49	23.46
HSUPA	1	21.94	22.06	22.42
	2	21.12	21.42	21.09
	3	21.32	21.00	20.75
	4	21.09	21.93	21.92
	5	22.24	22.43	22.40
DC-HSDPA	1	22.06	22.11	22.18
	2	22.03	22.07	22.15
	3	22.01	22.05	22.17
	4	22.04	22.10	22.13

11.5 Wi-Fi and BT Measurement result

The output power of BT antenna is as following:

Mode	Conducted Power (dBm)		
	Channel 0 (2402MHz)	Channel 39 (2441MHz)	Channel 78 (2480MHz)
GFSK	5.7	5.49	5.57

The average conducted power for Wi-Fi is as following: for head

802.11b (dBm)

Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps
1	17.45	/	/	/
6	17.65	/	/	/
11	17.92	17.82	17.70	17.37

802.11g (dBm)

Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1	14.85	/	/	/	/	/	/	/
6	15.27	/	/	/	/	/	/	/
11	15.58	15.40	15.19	14.85	14.50	13.95	13.49	13.31

802.11n (dBm) - HT20 (2.4G)

Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1	12.88	/	/	/	/	/	/	/
6	13.35	/	/	/	/	/	/	/
11	13.75	13.31	12.95	12.61	12.09	11.67	11.49	11.30

The average conducted power for Wi-Fi is as following: for body

802.11b (dBm)

Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps
1	17.47	/	/	/
6	17.45	/	/	/
11	17.99	17.89	17.67	17.43

802.11g (dBm)

Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1	15.05	/	/	/	/	/	/	/
6	15.02	/	/	/	/	/	/	/
11	15.54	15.37	15.18	14.84	14.49	13.92	13.46	13.29

802.11n (dBm) - HT20 (2.4G)

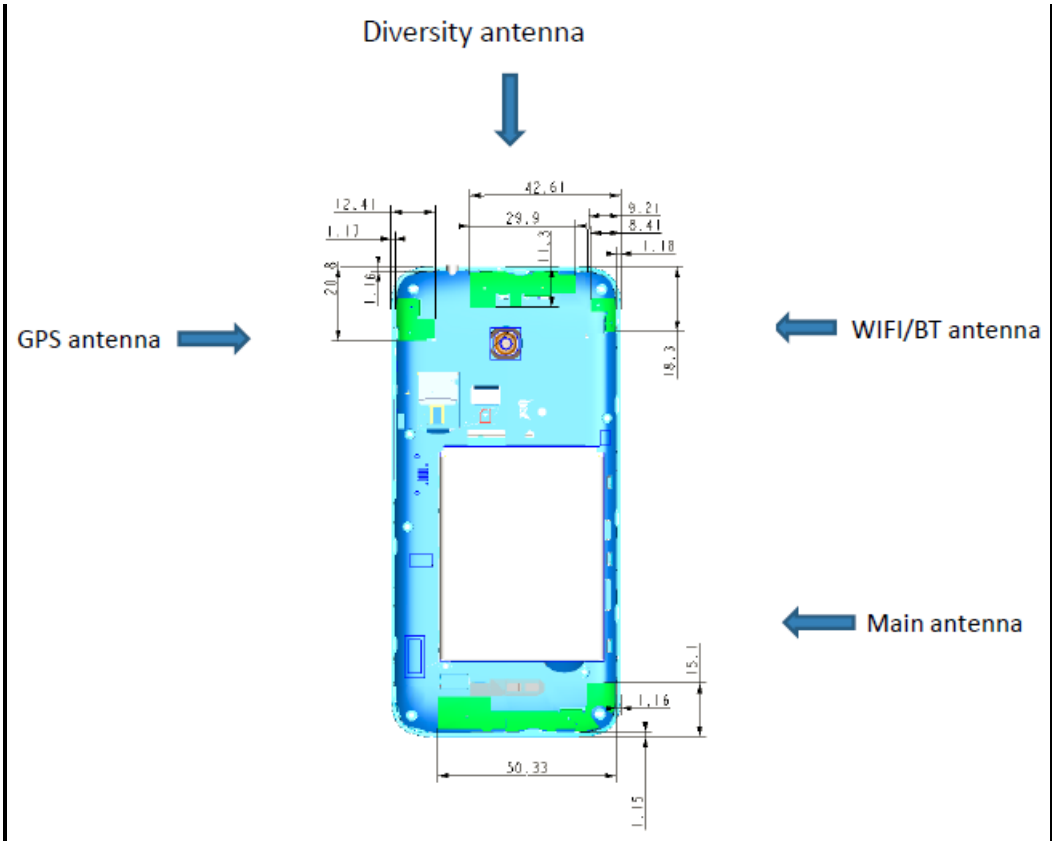
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1	13.06	/	/	/	/	/	/	/
6	13.02	/	/	/	/	/	/	/
11	13.62	13.21	12.83	12.48	11.95	11.49	11.32	11.12

12 Simultaneous TX SAR Considerations

12.1 Introduction

The following procedures adopted from “FCC SAR Considerations for Cell Phones with Multiple Transmitters” are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.
For this device, the BT and Wi-Fi can transmit simultaneous with other transmitters.

12.2 Transmit Antenna Separation Distances



Picture 12.1 Antenna Locations

12.3 SAR Measurement Positions

According to the KDB941225 D06 Hot Spot SAR v01, the edges with less than 2.5 cm distance to the antennas need to be tested for SAR.

SAR measurement positions						
Mode	Front	Rear	Left edge	Right edge	Top edge	Bottom edge
Main antenna	Yes	Yes	Yes	Yes	No	Yes
WLAN	Yes	Yes	Yes	No	Yes	No

12.4 Standalone SAR Test Exclusion Considerations

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied. The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

Table 12.1: Standalone SAR test exclusion considerations

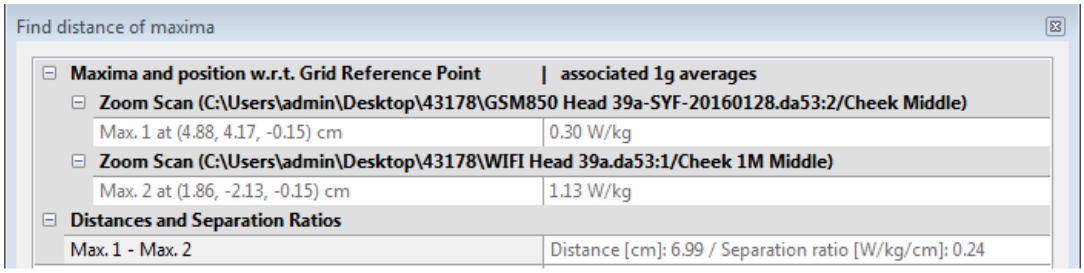
Band/Mode	F(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.441	Head	9.60	6	3.98	Yes
		Body	19.20	6	3.98	Yes
2.4GHz WLAN 802.11 b	2.45	Head	9.58	18	63.10	No
		Body	19.17	18	63.10	No

13 Evaluation of Simultaneous

Table 13.1: The sum of reported SAR values for main antenna and WLAN

	Band	Position	Main antenna	WLAN	Sum	Distance (mm)	Ratio
Maximum reported SAR value for Head	WCDMA 1900	Left hand, Touch cheek	0.76	0.58	**1.34**	**/**	**/**
	GSM 850	Right hand, Touch cheek	0.37	1.25	**1.62**	69.9	**0.03**
Maximum reported SAR value for Body	WCDMA 1700	Rear	1.14	0.29	**1.43**	/	**/**
	GSM 1900	Bottom	1.18	/	**1.18**	/	**/**

According to the KDB 447498 D01, when the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The ratio is determined by $(SAR1 + SAR2)^{1.5}/Ri$, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.



Picture 13.1 Distance evaluation for GSM 850 and WLAN

Table 13.2: The sum of reported SAR values for main antenna and Bluetooth

	Position	Main antenna	BT*	Sum
Highest reported SAR value for Head	Left hand, Touch cheek	0.76	0.17	**0.93**
Highest reported SAR value for Body	Rear	1.14	0.08	**1.22**
	Bottom	1.18	/	**1.18**

BT* - Estimated SAR for Bluetooth (see the table 13.3)

Table 13.3: Estimated SAR for Bluetooth

Position	F (GHz)	Distance (mm)	Upper limit of power *		Estimated$_{1g}$ (W/kg)
			dBm	mW	
Head	2.441	5	6	3.98	0.17
Body	2.441	10	6	3.98	0.08

* - Maximum possible output power declared by manufacturer

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance,mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm; where x = 7.5 for 1-g SAR. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Conclusion:

According to the above tables, the sum of reported SAR values is > 1.6 W/kg, but the SAR to peak location separation ratio < 0.04. So the simultaneous transmission SAR with volume scans is not required.

14 SAR Test Result

It is determined by user manual for the distance between the EUT and the phantom bottom. The distance is 10mm or 15mm and just applied to the condition of body worn accessory.
It is performed for all SAR measurements with area scan based 1-g SAR estimation (Fast SAR). A zoom scan measurement is added when the estimated 1-gSAR is the highest measured SAR in each exposure configuration, wireless mode and frequency band combination or >1.2W/kg.
The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{Target}-P_{Measured})/10}$$

Where P_{Target} is the power of manufacturing upper limit;
$P_{Measured}$ is the measured power in chapter 11.

Duty Cycle	
Speech for GSM850/1900	1:8.3
GPRS&EGPRS for GSM850	1:4
GPRS&EGPRS for GSM1900	1:2.67
WCDMA	1:1

14.1 SAR results for Fast SAR

Table 14.1-1: SAR Values (GSM 850 MHz Band - Head)

Ambient Temperature: 23.0 °C					Liquid Temperature: 22.5°C						
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
848.8	251	Left	Touch	/	32.56	33.5	0.202	**0.25**	0.293	**0.36**	-0.02
836.6	190	Left	Touch	Fig.1	32.50	33.5	0.237	**0.30**	0.309	**0.39**	0.03
824.2	128	Left	Touch	/	32.66	33.5	0.198	**0.24**	0.286	**0.35**	0.09
836.6	190	Left	Tilt	/	32.50	33.5	0.177	**0.22**	0.255	**0.32**	-0.14
836.6	190	Right	Touch	/	32.50	33.5	0.231	**0.29**	0.297	**0.37**	-0.10
836.6	190	Right	Tilt	/	32.50	33.5	0.205	**0.26**	0.300	**0.38**	0.05

Table 14.1-2: SAR Values (GSM 850 MHz Band - Body)

Ambient Temperature: 23.0 °C						Liquid Temperature: 22.5°C					
Frequency		Mode (number of timeslots)	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
836.6	190	GPRS (2)	Front	/	30.37	30.5	0.244	**0.25**	0.347	**0.36**	-0.01
848.8	251	GPRS (2)	Rear	Fig.2	30.34	30.5	0.440	**0.46**	0.760	**0.79**	-0.07
836.6	190	GPRS (2)	Rear	/	30.37	30.5	0.306	**0.31**	0.441	**0.45**	-0.08
824.2	128	GPRS (2)	Rear	/	30.47	30.5	0.305	**0.31**	0.440	**0.44**	-0.08
836.6	190	GPRS (2)	Left	/	30.37	30.5	0.243	**0.25**	0.360	**0.37**	-0.19

836.6	190	GPRS (2)	Right	/	30.37	30.5	0.152	**0.16**	0.224	**0.23**	-0.07
836.6	190	GPRS (2)	Bottom	/	30.37	30.5	0.078	**0.08**	0.129	**0.13**	-0.08
848.8	251	EGPRS (2)	Rear	/	30.35	30.5	0.308	**0.32**	0.441	**0.46**	-0.03

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.1-3: SAR Values (GSM 1900 MHz Band - Head)

Ambient Temperature: 23.0 °C						Liquid Temperature: 22.5°C					
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
1909.8	810	Left	Touch	Fig.3	29.64	30.5	0.197	**0.24**	0.322	**0.39**	0.14
1880	661	Left	Touch	/	29.50	30.5	0.177	**0.22**	0.304	**0.38**	0.19
1850.2	512	Left	Touch	/	29.35	30.5	0.164	**0.21**	0.281	**0.37**	0.13
1880	661	Left	Tilt	/	29.50	30.5	0.051	**0.06**	0.087	**0.11**	0.04
1880	661	Right	Touch	/	29.50	30.5	0.095	**0.12**	0.154	**0.19**	-0.03
1880	661	Right	Tilt	/	29.50	30.5	0.068	**0.09**	0.117	**0.15**	0.05

Table 14.1-4: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 23.0 °C							Liquid Temperature: 22.5°C				
Frequency		Mode (number of timeslots)	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
1880	661	GPRS (3)	Front	/	25.94	27	0.330	**0.42**	0.591	**0.75**	-0.03
1909.8	810	GPRS (3)	Rear	/	26.00	27	0.428	**0.54**	0.771	**0.97**	-0.13
1880	661	GPRS (3)	Rear	/	25.94	27	0.397	**0.51**	0.737	**0.94**	-0.02
1850.2	512	GPRS (3)	Rear	/	25.95	27	0.385	**0.49**	0.700	**0.89**	-0.04
1850.2	512	GPRS (3)	Left	/	25.94	27	0.148	**0.19**	0.259	**0.33**	-0.17
1850.2	512	GPRS (3)	Right	/	25.94	27	0.022	**0.03**	0.037	**0.05**	-0.11
1909.8	810	GPRS (3)	Bottom	Fig.4	25.94	27	0.473	**0.60**	0.926	**1.18**	-0.09
1880	661	GPRS (3)	Bottom	/	25.94	27	0.360	**0.46**	0.747	**0.95**	-0.09
1850.2	512	GPRS (3)	Bottom	/	25.94	27	0.335	**0.43**	0.692	**0.88**	-0.07
1909.8	810	EGPRS (3)	Bottom	/	25.98	27	0.398	**0.50**	0.781	**0.99**	-0.16

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.1-5: SAR Values (WCDMA 850 MHz Band - Head)

Ambient Temperature: 23.0 °C						Liquid Temperature: 22.5°C					
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
846.6	4233	Left	Touch	/	23.45	24	0.248	**0.28**	0.361	**0.41**	0.13
836.4	4182	Left	Touch	/	23.28	24	0.246	**0.29**	0.358	**0.42**	0.02
826.4	4132	Left	Touch	Fig.5	23.27	24	0.279	**0.33**	0.370	**0.44**	0.17
836.4	4182	Left	Tilt	/	23.28	24	0.150	**0.18**	0.218	**0.26**	0.03

836.4	4182	Right	Touch	/	23.28	24	0.174	**0.21**	0.216	**0.25**	-0.04
836.4	4182	Right	Tilt	/	23.28	24	0.119	**0.14**	0.176	**0.21**	-0.03

Table 14.1-6: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 23.0 °C						Liquid Temperature: 22.5°C				
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.4	4182	Front	/	23.38	24	0.204	**0.24**	0.289	**0.33**	0.04
846.6	4233	Rear	/	23.37	24	0.241	**0.28**	0.353	**0.41**	0.11
836.4	4182	Rear	Fig.6	23.38	24	0.308	**0.36**	0.412	**0.48**	0.05
826.4	4132	Rear	/	23.28	24	0.241	**0.28**	0.351	**0.41**	-0.05
836.4	4182	Left	/	23.38	24	0.177	**0.20**	0.263	**0.30**	0.11
836.4	4182	Right	/	23.38	24	0.178	**0.21**	0.264	**0.30**	0.06
836.4	4182	Bottom	/	23.38	24	0.070	**0.08**	0.106	**0.12**	-0.02

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.1-7: SAR Values (WCDMA 1700 MHz Band - Head)

Ambient Temperature: 23.0 °C							Liquid Temperature: 22.5°C				
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
1752.6	1513	Left	Touch	Fig.7	23.57	24	0.335	**0.37**	0.531	**0.59**	0.19
1732.4	1412	Left	Touch	/	23.60	24	0.331	**0.36**	0.521	**0.57**	0.14
1712.4	1312	Left	Touch	/	23.55	24	0.270	**0.30**	0.444	**0.49**	0.13
1732.4	1412	Left	Tilt	/	23.60	24	0.070	**0.08**	0.113	**0.12**	0.16
1732.4	1412	Right	Touch	/	23.60	24	0.158	**0.17**	0.238	**0.26**	0.15
1732.4	1412	Right	Tilt	/	23.60	24	0.058	**0.06**	0.094	**0.10**	0.15

Table 14.1-8: SAR Values (WCDMA 1700 MHz Band - Body)

Ambient Temperature: 23.0 °C						Liquid Temperature: 22.5°C				
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1732.4	1412	Front	/	23.45	24	0.369	**0.42**	0.637	**0.72**	-0.09
1752.6	1513	Rear	/	23.45	24	0.502	**0.57**	0.805	**0.91**	-0.08
1732.4	1412	Rear	/	23.45	24	0.561	**0.64**	0.910	**1.03**	-0.11
1712.4	1312	Rear	Fig.8	23.39	24	0.654	**0.75**	0.993	**1.14**	-0.01
1732.4	1412	Left	/	23.45	24	0.112	**0.13**	0.196	**0.22**	0.11
1732.4	1412	Right	/	23.45	24	0.075	**0.09**	0.132	**0.15**	-0.03
1732.4	1412	Bottom	/	23.45	24	0.331	**0.38**	0.650	**0.74**	0.06

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.1-9: SAR Values (WCDMA 1900 MHz Band - Head)

Ambient Temperature: 23.0 °C		Liquid Temperature: 22.5°C									
Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
1907.6	9538	Left	Touch	/	23.83	24	0.359	**0.37**	0.636	**0.66**	0.17
1880	9400	Left	Touch	/	23.78	24	0.409	**0.43**	0.672	**0.71**	0.13
1852.4	9262	Left	Touch	Fig.9	23.68	24	0.427	**0.46**	0.708	**0.76**	0.10
1880	9400	Left	Tilt	/	23.78	24	0.144	**0.15**	0.192	**0.20**	0.06
1880	9400	Right	Touch	/	23.78	24	0.198	**0.21**	0.333	**0.35**	0.07
1880	9400	Right	Tilt	/	23.78	24	0.127	**0.13**	0.219	**0.23**	0.05

Table 14.1-10: SAR Values (WCDMA 1900 MHz Band - Body) – AP ON

Ambient Temperature: 23.0 °C		Liquid Temperature: 22.5°C								
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	9400	Front	/	22.49	22.5	0.344	**0.34**	0.608	**0.61**	-0.04
1880	9400	Rear	/	22.49	22.5	0.389	**0.39**	0.674	**0.68**	-0.07
1880	9400	Left	/	22.49	22.5	0.154	**0.15**	0.277	**0.28**	0.07
1880	9400	Right	/	22.49	22.5	0.030	**0.03**	0.052	**0.05**	0.10
1907.6	9538	Bottom	Fig.10	22.47	22.5	0.521	**0.53**	1.03	**1.04**	0.03
1880	9400	Bottom	/	22.49	22.5	0.412	**0.41**	0.824	**0.83**	-0.02
1852.4	9262	Bottom	/	22.50	22.5	0.363	**0.36**	0.724	**0.72**	-0.04

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.1-11: SAR Values (WCDMA 1900 MHz Band - Body) – AP OFF

Ambient Temperature: 23.0 °C		Liquid Temperature: 22.5°C								
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	9400	Front	/	23.49	24	0.252	**0.28**	0.429	**0.48**	-0.08
1907.6	9538	Rear	Fig.11	23.39	24	0.329	**0.38**	0.547	**0.63**	0.11
1880	9400	Rear	/	23.49	24	0.298	**0.33**	0.500	**0.56**	0.00
1852.4	9262	Rear	/	23.46	24	0.276	**0.31**	0.466	**0.53**	-0.01

Note1: The distance between the EUT and the phantom bottom is 15mm.